

Graphene in Electronics and Energy: the Global Market to 2020

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Abstracts

Driven by demand from markets where advanced materials are required, graphene promises to outstrip all current nanomaterials, especially in electronics and energy storage applications. Other markets graphene is impacting include aerospace, automotive, coatings and paints, communications, sensors, solar, oil, and lubricants. The exceptional electron and thermal transport, mechanical properties, chemical stability of graphene and combinations thereof make it a potentially disruptive technology for electronics and energy applications. Application areas at different stages of commercial development include:

Energy

Lithium-Ion Batteries

Supercapacitors

Fuel Cells

Photovoltaics.

Electronics

Transparent Conductors

Optical Switches

Transistors and Integrated Circuit

Memory Devices

Spintronics.

Applications are coming onto the market for polymer composites and EMI shielding coatings. Graphene-based conducting inks are also finding their way into smart cards and radio-frequency identification tags. China is expecting to bring graphene products to the market in 2014 in consumer electronics. Companies such as IBM and Samsung are pursuing applications for graphene in electronics and optics. Most major Li-ion battery manufacturers and electronics companies, especially in Asia, have significant research initiatives in graphene.

Many of the current and potential applications of carbon nanotubes may be taken by graphene, as it displays enhanced properties but with greater ease of production and handling. In this regard, carbon nanotubes may be viewed as a stalking horse for commercial applications of graphene. In the next 2-3 years there is likely to be graphene enabled-applications in ultra thin flexible Li ion batteries, large supercapacitors, water membranes, biosensors, optical sensors, solar cells and conductive composites.

The projected “killer app” for graphene has been identified as transparent conductive films for displays, but that is not proven yet. Enhancement of conductive inks and composites are viewed as shorter-term opportunities. In electronics, competition from silicon in semiconductors. Other competing technologies include silver nanowires and carbon nanotubes as well as other 2D materials such as boron nitride, molybdenum disulfide, tungsten tungsten disulfide and germanane.

The current overall graphene market is estimated to be between US\$13-\$15 million. However this will grow significantly in the next 10 years and is likely to be larger than projected figures from a number of market consultancies. For example, XG Sciences have over 600 customers in the automotive, electronics, battery and aerospace industries, and the company generated \$4 million in revenue in 2012. Most of the major graphene producers have relationships with electronics and battery OEMs.

This 130 page report from Future Markets, Inc. includes:

Analysis of graphene production, graphene types, scalability, cost and product integration

Analysis of graphene in the energy market, covering Li-ion batteries, photovoltaics, fuel cells and supercapacitors. Each technology area includes market size estimates, stage of development, research and industry developments in 2013, and product developers.

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Many of the current and potential applications of carbon nanotubes may be taken by graphene.

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Many of the current and potential applications of carbon nanotubes may be taken by graphene.

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GRAPHENE IN THE ELECTRONICS SECTOR

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